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Botulism: Lethal in Three Forms

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Botulinum toxin is one of the most lethal substances recognized. Known historically as a risk associated with home-canned food, botulism in Washington more recently has been associated with injection use of contaminated black tar heroin. Botulism's use as a potential agent of bioterrorism is also a concern.

The Organism

Identified in 1897, the agent of botulism was named for the home-fermented sausages associated with an outbreak of the disease (Latin *botulus* – sausage). The bacteria producing botulinum toxin belong to a genus responsible for many other serious toxin-related illnesses: tetanus (*Clostridium tetani*), gas gangrene (*C. perfringens* and other species), pseudomembranous colitis (*C. difficile*), and one form of foodborne diarrhea (*C. perfringens*).

C. botulinum is an obligate anaerobe (requires absence of oxygen to grow) and produces hardy spores. Botulinum spores are ubiquitous, occurring in soil, the intestinal tracts of animals, and agricultural products. Spores can survive boiling, freezing, or drying, but are deactivated with pressure cooking or autoclaving. Seven types (A–G) of *C. botulinum* produce different neurotoxins. In addition to *C. botulinum,* rare cases of botulism are due to toxins from *C. butyricum* or *C. baratii.*

Botulism toxin irreversibly binds neuronal receptors to prevent the release of the neurotransmitter acetylcholine. Symptoms reflect this paralytic effect, but the precise clinical presentation depends on the route of exposure and the dose. The illness occurs in one of three general ways: foodborne, intestinal, or wound botulism.

Foodborne Botulism

Ingesting preformed toxin in food results in the classic form of botulism. Commercial products are only rarely responsible for illness, although foods improperly preserved in oil, which creates an anaerobic environment, have been a risk. In Alaska, botulism cases are most often associated with the preparation and storage of traditional Alaska Native foods including "fermented" or dried marine mammals and fish, and traditionally prepared condiments such as seal oil.

In Washington, most of the recent foodborne botulism cases are due to improperly home-canned non-acid foods including asparagus, beets, corn, carrots, spinach, and salsa. Traditional food preservation methods such as drying, pickling with acid, salting, or sugaring inhibit the growth of botulism. Most foodborne botulism is due to type A or B; type E is a particular risk with home-canned fish. Unlike the spores, the toxin is heat sensitive and will be destroyed if all parts of the food are cooked to boiling temperature before serving.

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Ingestion of botulinum toxin causes acute bilateral cranial nerve impairment and descending symmetric weakness or paralysis that can compromise respiratory function. Typical cranial nerve problems are blurred or double vision (diplopia), drooping eyelids (ptosis), difficulty swallowing (dysphagia), difficulty speaking (dysarthria), and dry mouth (xerostomia). Cramps, vomiting, and diarrhea may occur first, probably the result of other contaminants in the food. Fever is absent unless a complicating infection occurs.

Intestinal (Infant) Botulism

Growth of botulism in the large intestine may occur in normal infants, or very rarely in adults with altered intestinal anatomy. The risk factors for infant botulism are poorly described, but possible sources of spores include dust and foods such as honey. Most cases of intestinal botulism are caused by type A or B.

The typical patient is an infant under 6 months of age with severe constipation and progressive weak feeding that may be diagnosed as failure to thrive. Neurologic symptoms include diminished crying, drooping eyelids, poor muscle tone of the neck and extremities ("floppy baby"), and in some cases respiratory failure. Severity varies widely, ranging from mild illness with gradual onset and recovery to sudden acute illness and death.

Wound Botulism

Clostridial growth in abscesses can result in release of toxin into the circulation. First reported from California in 1998, subcutaneous heroin use ("skin popping") as a cause of botulism has become an established problem in western states, including Washington. Since 2002, wound botulism associated with heroin use has been the most common type of botulism reported in Washington (Figure 1, page 3). Most wound botulism is caused by type A toxin.

Gastrointestinal symptoms are absent, but neurologic findings are indistinguishable from those seen in foodborne botulism. Wounds with clostridial growth are often detected as abscesses, but some are subtle and lacking swelling, redness, or tenderness. Ultrasound examination of body areas used for drug injection may identify such abscesses. Following antitoxin administration, the abscesses should be thoroughly debrided and treated with antibiotics.

Diagnosis and Treatment

Differential diagnosis of botulism in an older child or adult includes other conditions causing neurologic deficits or paralysis, such as Guillain Barré syndrome, myasthenia gravis, electrolyte abnormalities, stroke, Reye syndrome, toxins, congenital neuromuscular syndromes, poliomyelitis, paralytic shellfish poisoning, and tick paralysis. In an infant also consider sepsis, especially meningitis.

The laboratory analyses of cerebrospinal fluid (CSF), Tensilon® test results, and brain scans or imaging are all normal in botulism cases. Electromyography with rapid repetitive stimulation (potentiated response) can corroborate the diagnosis. Careful monitoring of respiratory vital capacity is useful in determining disease progression.

Standard diagnostic tests include serologic analysis for the presence of toxin and culturing the organism. DOH Public Health Laboratories can test serum, stool, implicated food, and wound exudate or debrided tissue. Testing may take several days, so decisions about treatment should be based on history and physical findings, and not await results of diagnostic tests.

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New Phone Numbers

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CDE Main Number (24-hour)
206-418-5500

Botulinum antitoxin is administered in suspected cases of foodborne or wound botulism to reduce the progression or severity of illness. Therapy is more effective if begun early in the course of illness because the antitoxin neutralizes circulating unbound toxin. Administration of equine antitoxin is preceded by skin testing to avoid hypersensitivity reactions. The two types of antitoxin are AB and ABE; the latter is used when the suspected source is fish or other marine product. In severe cases, ventilatory support is needed and recovery takes weeks to months. Infants with intestinal botulism may be treated with intramuscular injection of human-derived botulinum antitoxin obtained through the California Department of Health Services, 24 hours/day (510-540-2646). Information is available at the department website: www.infantbot.org

Public Health Interventions

Botulism is an immediately notifiable condition in Washington. Public health interventions include facilitating the rapid release and transport of antitoxin for patient treatment, providing laboratory testing, investigating the source of exposure to identify additional cases and prevent further exposures, and collecting and disseminating data on cases to alert health care professionals and evaluate for possible bioterrorism associated risk.

For Assistance with Diagnosis and Treatment

Consult the local health jurisdiction or DOH at 206-418-5500, which can be reached 24/7.

For More Information

www.doh.wa.gov/phepr/handbook/botulism.htm

Figure 1: Botulism cases in Washington, 1983–2003